

FIG. 1

		Time Periods				
		$t_0$	$t_1$	$t_2$	$t_3$	$t_4$
Domain Model	Quantity 1	$n_{0,1}$	$n_{1,1}$	$n_{2,1}$	$n_{3,1}$	$n_{4,1}$
	Quantity 2	$n_{0,2}$	$n_{1,2}$	$n_{2,2}$	$n_{3,2}$	$n_{4,2}$
	Quantity 3	$n_{0,3}$	$n_{1,3}$	$n_{2,3}$	$n_{3,3}$	$n_{4,3}$
	Quantity 4	$n_{0,4}$	$n_{1,4}$	$n_{2,4}$	$n_{3,4}$	$n_{4,4}$
	.	.	.	.	.	.
	.	.	.	.	.	.
	.	.	.	.	.	.
		state at time $t_3$				

$n$ : a numeric value

FIG. 2

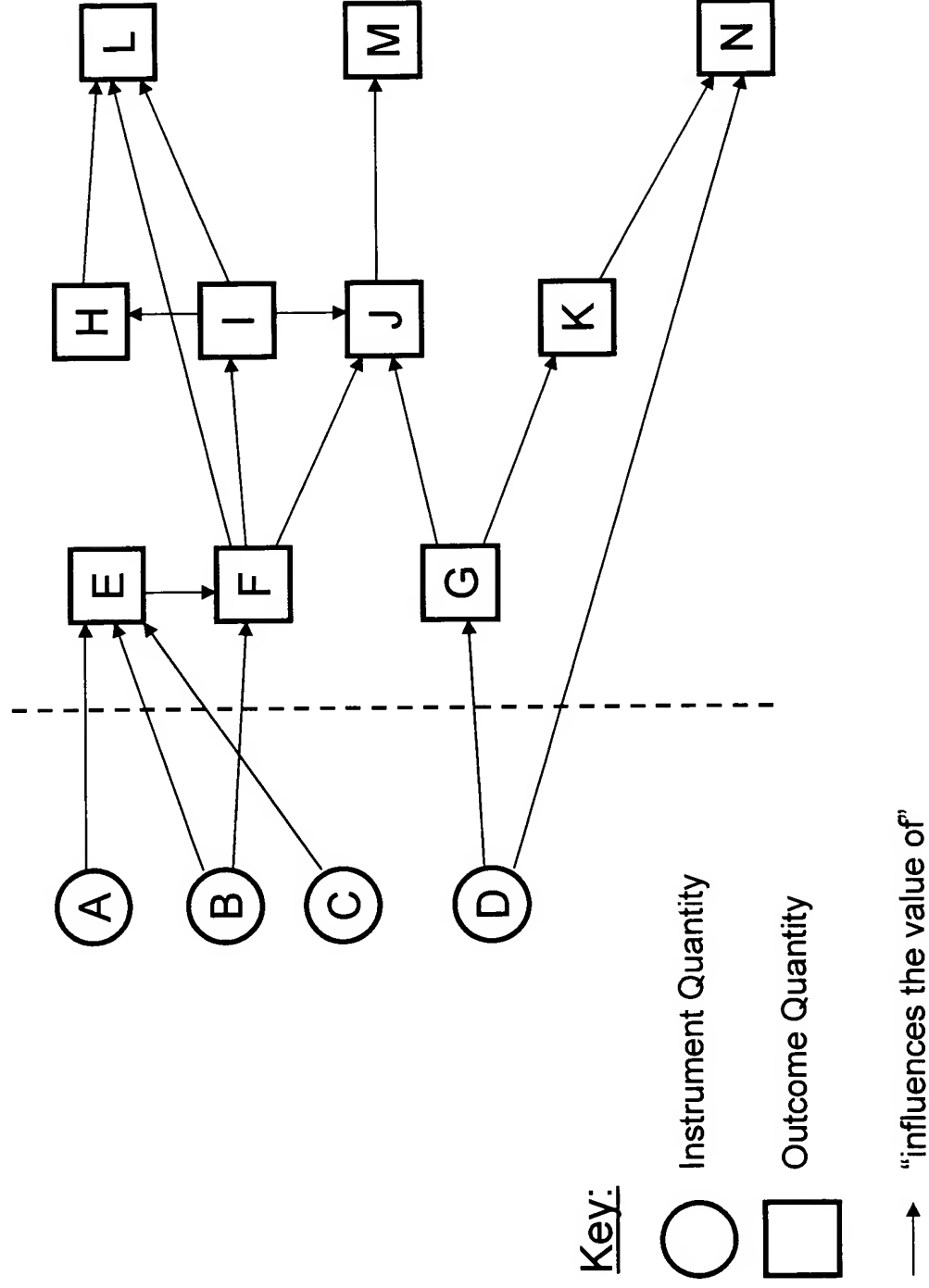


FIG. 3

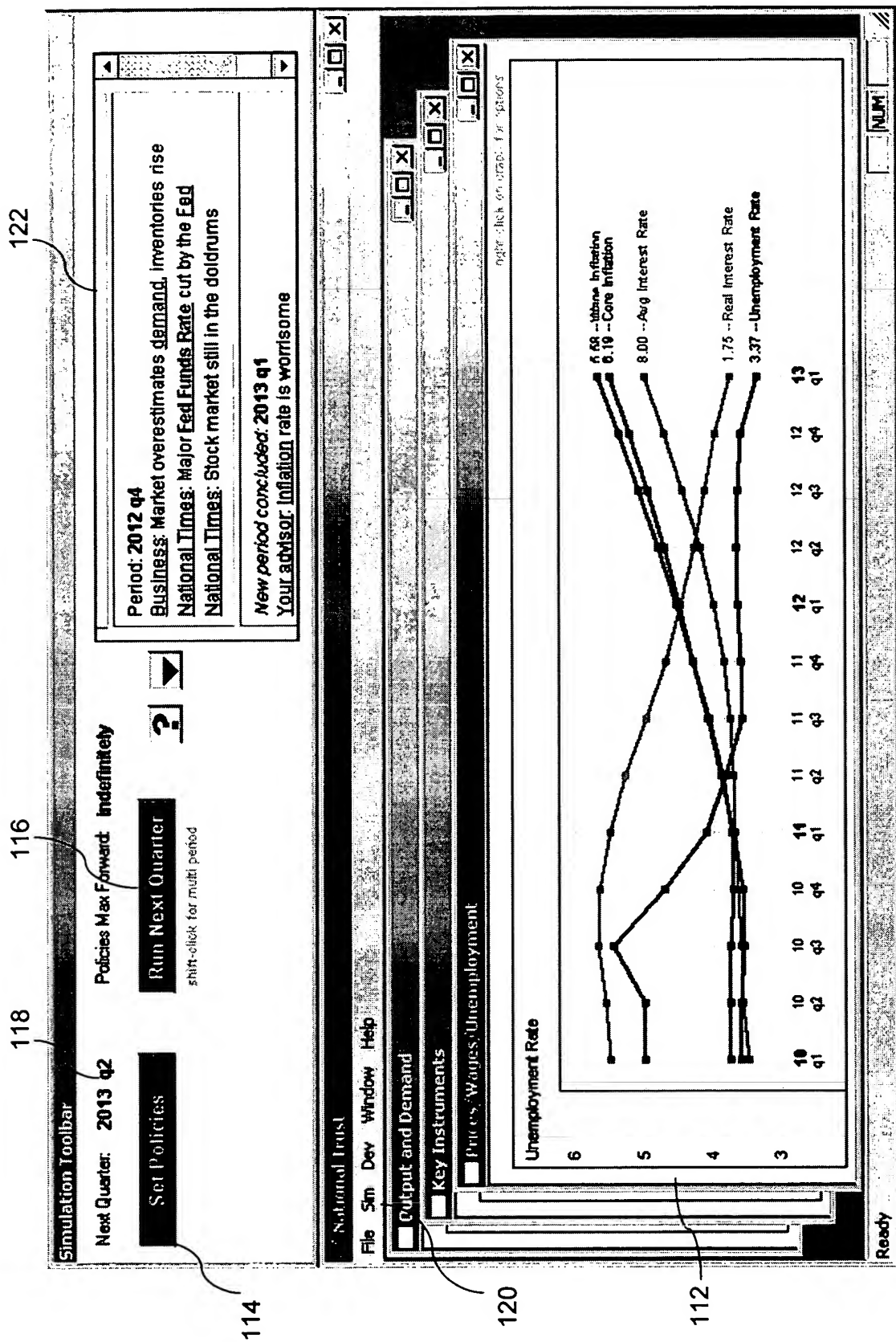
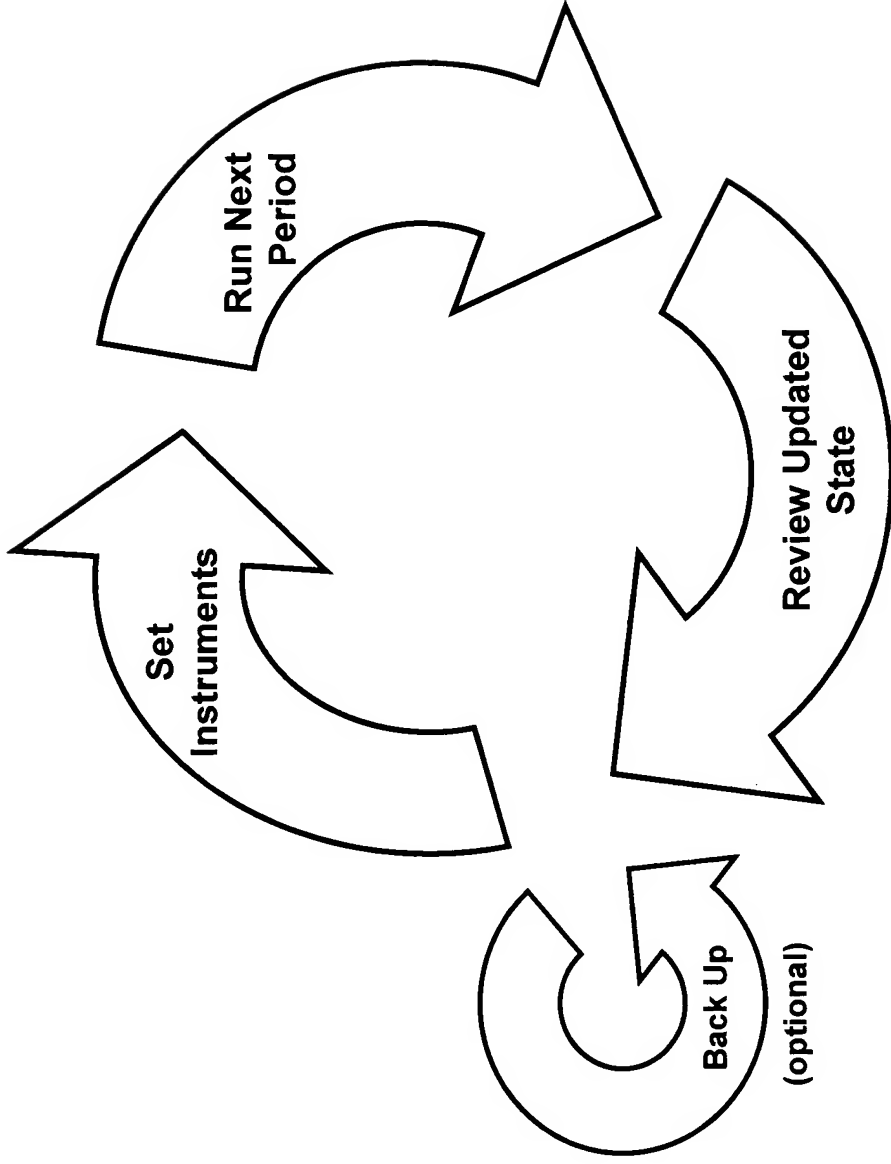


FIG. 4



**FIG. 5**

FIG. 6

<input type="checkbox"/> All Quantity Values			
Quarter:	2013 q1	Click name for definition	Done
Actual Banking Regulation	6		
Aggregate Bad Loans	84.7427		
Aggregate Demand	3483.69		
Avg Interest Rate	8.00058		
Avg Retirement Benefit	5000		
Avg Unemployment Benefit	2681.02		
Bad Loans Pctg	0.5566		
Banking Regulation	6		
Banking System Bailout	0		
Birth Rate	2.1		
Budget Surplus	-84.8697		
Capital Stock	16582.6		
Consumer Confidence Index	58.2302		
Consumption	2373.32		
Consumption Volatility Constant	0.5		
Core Inflation	6.19549		
Core Inflation - Quarterly Rate	1.54887		
Corporate Profit Pctg	7.11927		
Corporate Profits	263.622		
Corporate Tax Rate	38.5714		
Corporate Taxes	101.683		

142

140

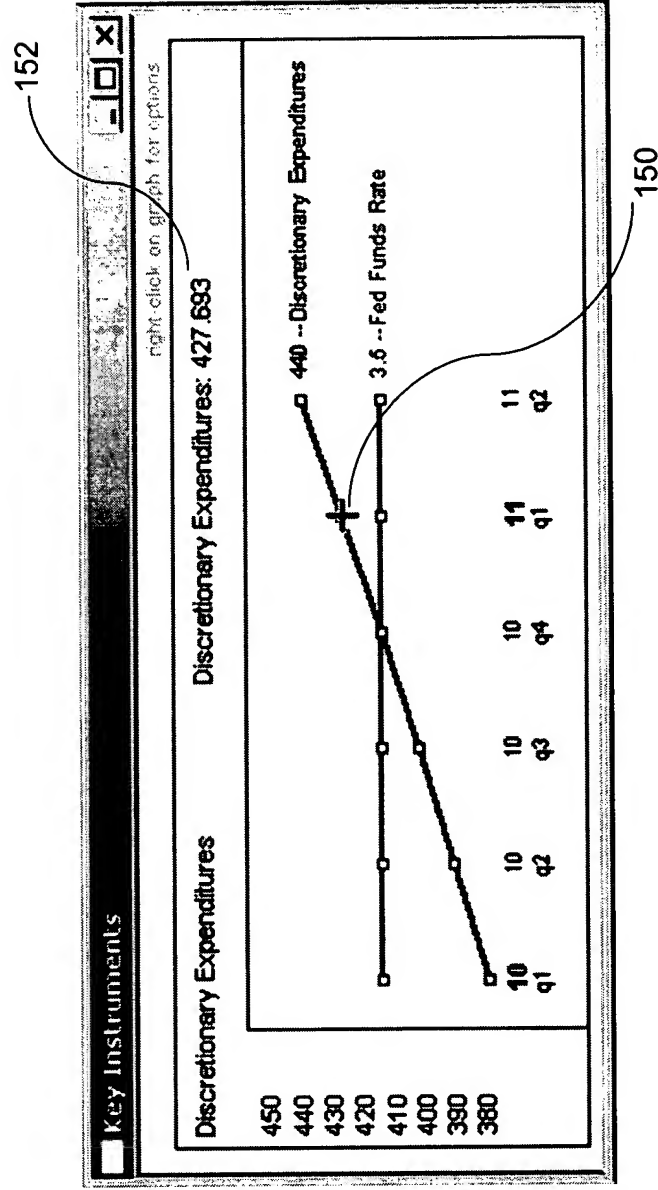


FIG. 7

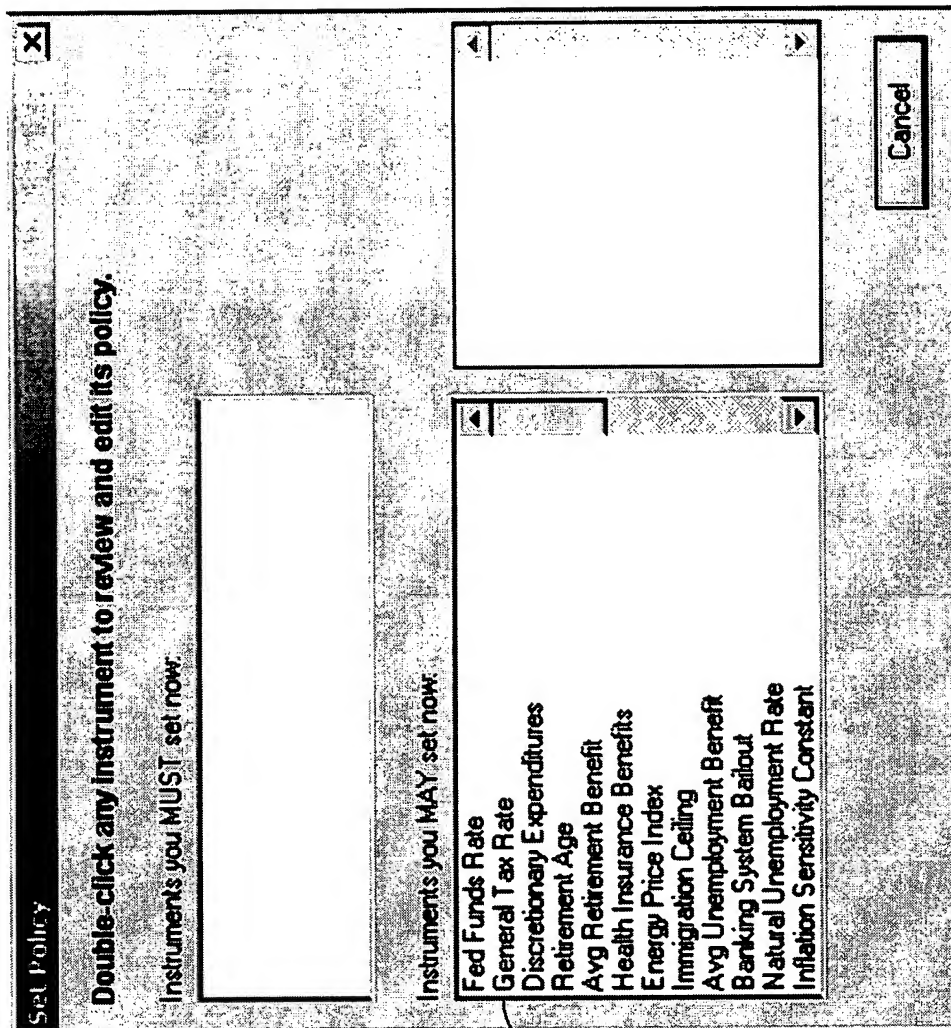


FIG. 8



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Set Policy

Instrument: **Fed Funds Rate**


Last quarter's value:

Choose a person to control this instrument, or control it yourself:

Choose Functionary

Set My Own Values


George May



174

"I favor an activist policy that seeks to smooth out the bumps in the business cycle. My primary goal is to help stabilize employment, and strategic control of liquidity in the system is a powerful tool for achieving this."


Martha Gilbert



175

"The Federal Reserve is responsible for controlling and, indeed, preventing inflation, and that is my primary guide to setting interest rates. I am quick to increase rates when I see an uptick in wage or price inflation, but I am willing to ease somewhat in recessions."

Jim Sparks



176

"My strategy is basically to try to counter the current growth trend in aggregate demand. If aggregate demand is increasing, I increase rates; if it's decreasing, I decrease rates to try to add liquidity and spur investment spending."

Force review in  periods.

(Enter 1 or more, or leave blank for indefinite period.)

See Quantity Description

OK

Cancel

Help

178

FIG. 9

Set Policy

Instrument: **Fed Funds Rate**

Last quarter's value:

Choose a person to control this instrument, or control it yourself.

Choose Functionary

Set My Own Values

See Quantity Description

201

☐ Set only next quarter value

Next qtr value:

202

☐ Set specific values for several quarters

Indicate two or more values, separated by spaces, starting with the next quarter value

203

☐ Keep constant value

Constant value:

204

☐ Grow with inflation

205

☐ Regular percentage increase

Increase per qtr (%)

206

☐ Regular percentage decrease

Decrease per qtr (%)

207

☐ Increment to target

Add each qtr:

211

212

215

Force review in  periods.

(Enter 1 or more, or leave blank for indefinite period.)

Help

Cancel

OK

FIG. 10

224

223

221

222

File Edit View Misc Help

Compute Order  
☐ Alpha Order  
☐ Q Group

New Q  
Delete Q  
Update Q

Get

Individual Tax Rate

Quantity Name: Individual Tax Rate

Definition: [ $\langle QName \rangle$  is ...] Macroed HTML, 2 to 4 sentences  
The  $\langle b \rangle \langle emb \rangle$  Individual Tax Rate  $\langle /emb \rangle \langle /b \rangle$  is the average rate of taxation on individual incomes. In practice, rates differ for individual citizens with different income levels.

Comments:

Unit: 0.01 Placeholder: 15

Type: pct - other Line color (3 n's): 0 100 20

In Graph Groups

"Taxes/Supplies" "All Instruments"

NDQ Specifications  
Select for edit: Dist (5 n's): Left movements (3 n's): Right movements (3 n's)/blank:

IF INSTRUMENT/EXTERNAL  
Current # of Instrument Functionaries: 3 Record Edit  
Select for edit: 2 - ratchet down to 9% Ideal Fay index: (blank or 1 if none)

IF NON-INSTRUMENT  
Explanation of Next Value Fn - Detailed discussion: Macroed HTML  
Next Value Function: put result in QJ Result use ctrl+Tab  
How Computed: 2 to 4 sentences: Macroed HTML (If c2ar, restate delegator description here in "outcome" language.)

NDQ Specifications  
Select for edit: Dist (5 n's): Left movements (3 n's): Right movements (3 n's)/blank:

IF INSTRUMENT/EXTERNAL  
Current # of Instrument Functionaries: 3 Record Edit  
Select for edit: 2 - ratchet down to 9% Ideal Fay index: (blank or 1 if none)

IF NON-INSTRUMENT  
Explanation of Next Value Fn - Detailed discussion: Macroed HTML  
Next Value Function: put result in QJ Result use ctrl+Tab  
How Computed: 2 to 4 sentences: Macroed HTML (If c2ar, restate delegator description here in "outcome" language.)

Ready

FIG. 11

Field Name	Data Type	Description
<i>Common fields</i>		
sName	string	A unique identifier for the quantity. This is the name that the student sees, and is also the name used within algorithms to access the quantity values in a scenario. Quantity identifiers are case-insensitive, and any two sequences of whitespace characters are always considered equivalent.
bInstrument	boolean	If FALSE, indicates that the quantity is an outcome quantity. If TRUE, indicates that the instrument is either an instrument quantity or an external quantity (described later).
sDefinition	string	Provides a brief textual description of the quantity, available to the student. Format is HTML, so that text formatting and links to related information can be embedded. All quantities should observe a similar style and voice in this field.
sUnit	string	A standardized text description of what kind of number value the quantity holds. Examples include "1 kilogram", "percent", "years", or "\$1 Billion".
dPlaceholder	floating point	The default initial value for the quantity, that is, for period 0.
sNewsFn	string	Optional. C code that can generate a qualitative description of a change in the state of the model (described later).
LineColor	integer	An RGB color value. This color is used as the line color whenever the quantity appears in any QuantitiesGroup window. It may also be used as the text color whenever the quantity name appears as a hyperlink anywhere in the learning environment.

FIG. 12A

Field Name	Data Type	Description
<i>Outcome-specific fields</i>		
sNextValueFn	string	C code that implements the outcome quantity's value-computation algorithm. Assumes the result will be placed in the predefined floating-point variable dQResult.
sNextValueDescr	string	Provides a brief textual description of the value-computation algorithm. Format is HTML, so that text formatting and links to related information can be embedded. All quantities should observe a similar style and voice in this field.
sExplainNVFn	string	Optional. Provides a longer, more detailed textual description of the value-computation algorithm. Format is HTML. Generally speaking, the more lines of code in sNextValueFn, the more highly recommended it is to use this field.
<i>Instrument-specific fields</i>		
bExternal	boolean	If TRUE, indicates that the quantity is an external quantity (described later) in all scenarios. If bInstrument is FALSE, this field is ignored.
sBoundsViolFn	string	C code that checks to ensure that a new instrument value is "legal" for the domain model. If the new value is out of bounds, whether too high or too low, the simulation may not be executed until the value is modified.
nFunctionaries	integer	The number of automated agents that have been defined for this instrument.
FunctionaryFns	array of strings	The C code implementing the algorithm for each of the defined agents. Assumes the result in each will be placed in the predefined floating-point variable dQResult. Each array element corresponds to one agent, and the array size is always equal to nFunctionaries.
FunctionaryStrategies	array of strings	Provides a brief textual description of the value-setting strategy for each of the defined agents. Should observe a similar style and voice in this field for all agents. Note that, depending upon pedagogical considerations, additional information or additional fields could be defined for each agent. For example, if each agent should have an associated picture, a field could be added for picture filenames.
InitDefaultFaryIndex	integer	Indicates which of the automated agents will be in effect initially when the scenario begins. If the quantity is an external, the indicated agent will control the value selection throughout the entire scenario.

FIG. 12B

Field Name	Outcome Quantity Example
sName	"Unemployment Rate"
bInstrument	FALSE
sDefinition	<p>"The Unemployment Rate is the percentage of the workforce that does not have gainful employment at a point in time. The workforce only includes persons who are willing and able to work.</p> <p>\$\$\$typical begin###  The unemployment rate can range from 2 percent to 30 percent. Higher rates are likely to lead to social breakdown.  \$\$\$typical end###</p> <p>\$\$\$model Inflation and Unemployment###"</p>
sUnit	0.01
dPlaceholder	5.0
sNewsFn	<pre>double dNatural = Value( "Natural Unemployment Rate", -1 ); double dExcess = dNewValue - dNatural;  if ( ( dExcess &gt; 2.0 ) &amp;&amp; ( dExcess &lt; 8.0 ) ) {     CString s; s.Format( "\$\$\$def Your advisor###: Unemployment rate of %.1f is worrisome", dNewValue );     AddNews( sQName,         s,         10,    // importance, scale 0-100 (default value is 1.0)         2      // "can repeat after" (must wait 3 quarters before repeating)     ); } if ( dExcess &gt;= 8.0 ) {     double dImportance = 50;     AddNews( sQName,         "\$\$\$def National Times###: Citizens desperate for relief from severe unemployment problem",         dImportance,         0     ); }</pre>
LineColor	(24 24 24)
sNextValueFn	<pre>double dReal = Value( "Real Output", -1 ); double dPotential = Value( "Potential Output", -1 ); double dRatio = dReal / dPotential; double dNatural = Value( "Natural Unemployment Rate", -1 ); double dLastUnem = Value( "Unemployment Rate", -1 ); double dTarget;  if ( dRatio &lt;= 1.0 ) // under capacity     dTarget = dNatural + ( 100.0 * (1.0 - dRatio) ); else     dTarget = dNatural * ( 1.0 / pow( dRatio, 10.0 ) );  dQResult = dLastUnem + ( 0.75 * ( dTarget - dLastUnem ) );</pre>
sNextValueDescr	"Computed as a function of the difference between \$\$\$qty Real Output### and \$\$\$qty Potential Output###. Unemployment is high when actual real output is less than potential, and the unemployment rate is low when actual is higher than potential. Greater differences between the two cause larger effects on unemployment."
sExplainNVFn	"Changes in unemployment result when there is a mismatch between output and the capacity of..."

FIG. 13

Fi Id Name	Instrum nt Quantity Example
sName	"Defense Expenditures"
bInstrument	TRUE
sDefinition	<p>"Defense Expenditures is the total amount spent for our military, including salaries, equipment, weaponry, and other expenses.</p> <p>\$\$\$typical begin###  Defense expenditures may be zero, or may soar above 10 percent of \$\$\$def total output total output### during wartime.  \$\$\$typical end###"</p>
sUnit	\$1 Billion
dPlaceholder	100
sNewsFn	<pre>double lastAmount = Value( "Defense Expenditures", -1 ); double pctg = PercentChange( lastAmount, dNewValue );  if ( pctg &gt; 10.0 ) {     AddNews( sQName,         "\$\$\$def National Times###: \$\$\$qty Defense Expenditures### increase dramatically ",         LinearEffect( pctg, 5.0, 20.0, 10, 40 ),         1 ); } }</pre>
LineColor	(0 0 140)
bExternal	FALSE
sBoundsViolFn	<pre>if ( dProposedNewValue &lt; 0.0 ) {     bTooLow = TRUE;     dValueLimit = 0.0;     sExplanation = "Defense Expenditures cannot be negative."; } else if ( dProposedNewValue &gt; Value( "Current Output", -1 ) ) {     bTooHigh = TRUE;     dValueLimit = Value( "Current Output", -1 );     sExplanation = "Defense Expenditures cannot possibly be greater than total output."; } }</pre>
nFunctionaries	2
FunctionaryFns	<p><i>Automated Agent 1:</i>  double dLowerLimit = Average( "Current Output", -4, -1 ) * 0.02;  dQResult = max( dLowerLimit, Value( "Defense Expenditures", -1 ) * 0.98 );</p> <p><i>Automated Agent 2:</i>  double dUpperLimit = Average( "Current Output", -4, -1 ) * 0.10;</p> <p>double dGrowthFactor = ( Value( "Price Index", -1 ) / Value( "Price Index", -2 ) ) * ( Value( "Potential Output", -1 ) / Value( "Potential Output", -2 ) );</p> <p>dQResult = min( dUpperLimit, Value( "Defense Expenditures", -1 ) * max( 1.02, dGrowthFactor ) );</p>
FunctionaryStrategies	<p><i>Automated Agent 1:</i>  "We need to reduce our heavy spending on military expenditures so that we can focus our economy's resources more on the private sector. Advances in military technology have made it possible for us to do more with less."</p> <p><i>Automated Agent 2:</i>  "We need to build up our defense capabilities. It's an increasingly dangerous world out there, and our weapons systems are getting old."</p>
InitDefaultFaryIndex	0

FIG. 14

232

IF INSTRUMENT/EXTERNAL

Current # of Instrument Functionaries:  Read

Select for edit:

0 - stabilize employment

Init Default F any index:  Ideal F any index:  [blank or -1 if none]

☐ External (fixed)

Default Set Subordinate Values Fn (if czar)

230

**FIG. 15**



240

IF INSTRUMENT/EXTERNAL

Current # of Instrument Functionaries:

Select for edit:

0 - stabilize employment	<input type="text" value="0"/>	<input type="button" value="Read"/>	<input type="checkbox"/> External (fixed)	<input type="text" value="Edit: Bounds Compute Code"/>
0 - stabilize employment	<input type="text" value="1"/>	<input type="button" value="Edit"/>	<input type="checkbox"/> External (fixed)	<input type="text" value="Edit: Bounds Violation Code"/>
1 - stabilize employment	<input type="text" value="2"/>	<input type="button" value="Edit"/>	<input type="checkbox"/> External (fixed)	<input type="text" value="Edit: Bounds Violation Code"/>
2 - based on ideal but less hawkish	<input type="text" value="3"/>	<input type="button" value="Edit"/>	<input type="checkbox"/> External (fixed)	<input type="text" value="Edit: Bounds Violation Code"/>
3 - IDEAL	<input type="text" value="4"/>	<input type="button" value="Edit"/>	<input type="checkbox"/> External (fixed)	<input type="text" value="Edit: Bounds Violation Code"/>
Add New Functionary (limited)	<input type="button" value="Add"/>	<input type="button" value="Edit"/>	<input type="checkbox"/> External (fixed)	<input type="text" value="Edit: Bounds Violation Code"/>
Delete LAST Functionary (limited)	<input type="button" value="Delete"/>	<input type="button" value="Edit"/>	<input type="checkbox"/> External (fixed)	<input type="text" value="Edit: Bounds Violation Code"/>

Default Set Subordinate Values Fr (if czar)

ion Macroed HTML

**FIG. 16**

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## The Macfarlane Tax Cuts

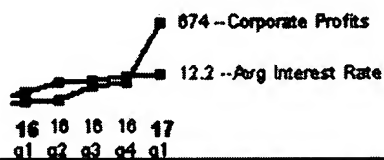
It is the year 2017, and the public and politicians alike are alarmed at the recent surge in unemployment. Unemployment has been low for the past decade, but it has recently shot up above 9 percent.

The Democrats are loudly denouncing the president almost every day. Republican Carl Macfarlane won the 2016 election on a tax-reduction campaign platform, and, once elected, he immediately pushed dramatic tax decreases into place. In the first year, the General Tax Rate has dropped from 26 percent of Current Output down to 18 percent; individual tax rates dropped significantly, and the Corporate Tax Rate has dropped from 40 percent down to about 20 percent.



To attack the unemployment problem, Congress is putting together a "stimulus" program which will significantly increase discretionary spending during the next two years. They argue that the increased spending will create jobs and stimulate investment.

Many economists, however, point to the chronically high rates of inflation that the country has been experiencing, and they warn that adding new spending on top of Macfarlane's dramatic tax cuts will "overstimulate" the economy and trigger even worse inflation. They suggest that the effects of the tax cut will only occur with a lag, and that the recent unemployment is likely to reverse itself any day now.



Meanwhile, the corporate tax cuts are already having big, positive effects on the level of Corporate Profits. Recent earnings reports from corporations have been spectacular, and stock prices are rising. Some business leaders

OK

FIG. 18

**Instrument Constraint** [X]

Quantity: **Individual Tax Rate** [v] **Q Info**

Should be an Instrument or External

☒ Instrument Enabled

External program: **0**

i.e. which functional algorithm to use if external (0, 1, etc.)

Enabled instruments only:

Enabled functional indexes, in desired order: [ ]

Example: if inst has 4 lays, could enter "2, 1" (sans quotes) to indicate only listing the second and first lays for the student.  
To indicate "use all lays, in predefined order" just leave field blank

Cancel [OK]

FIG. 19

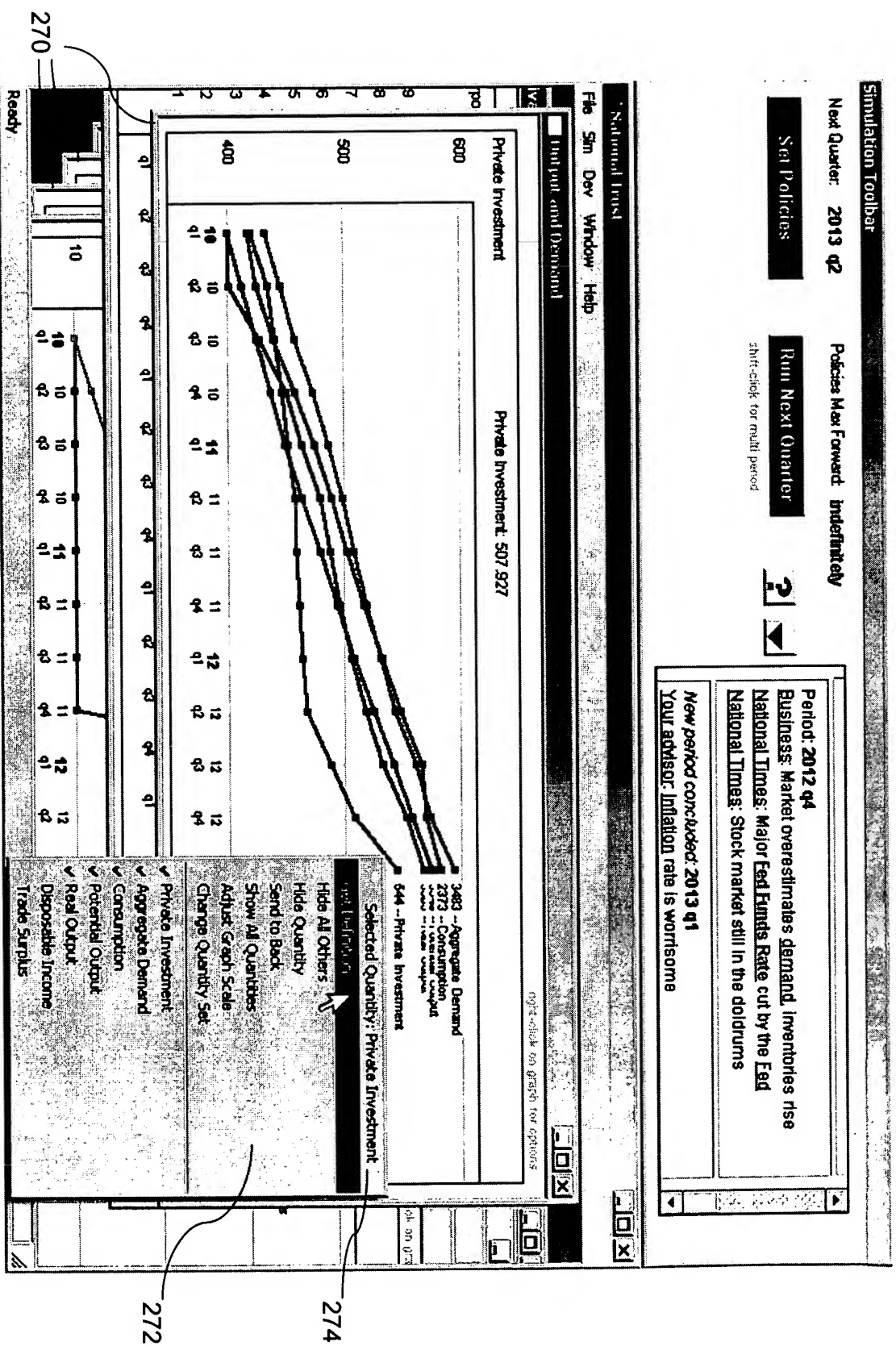


FIG. 20

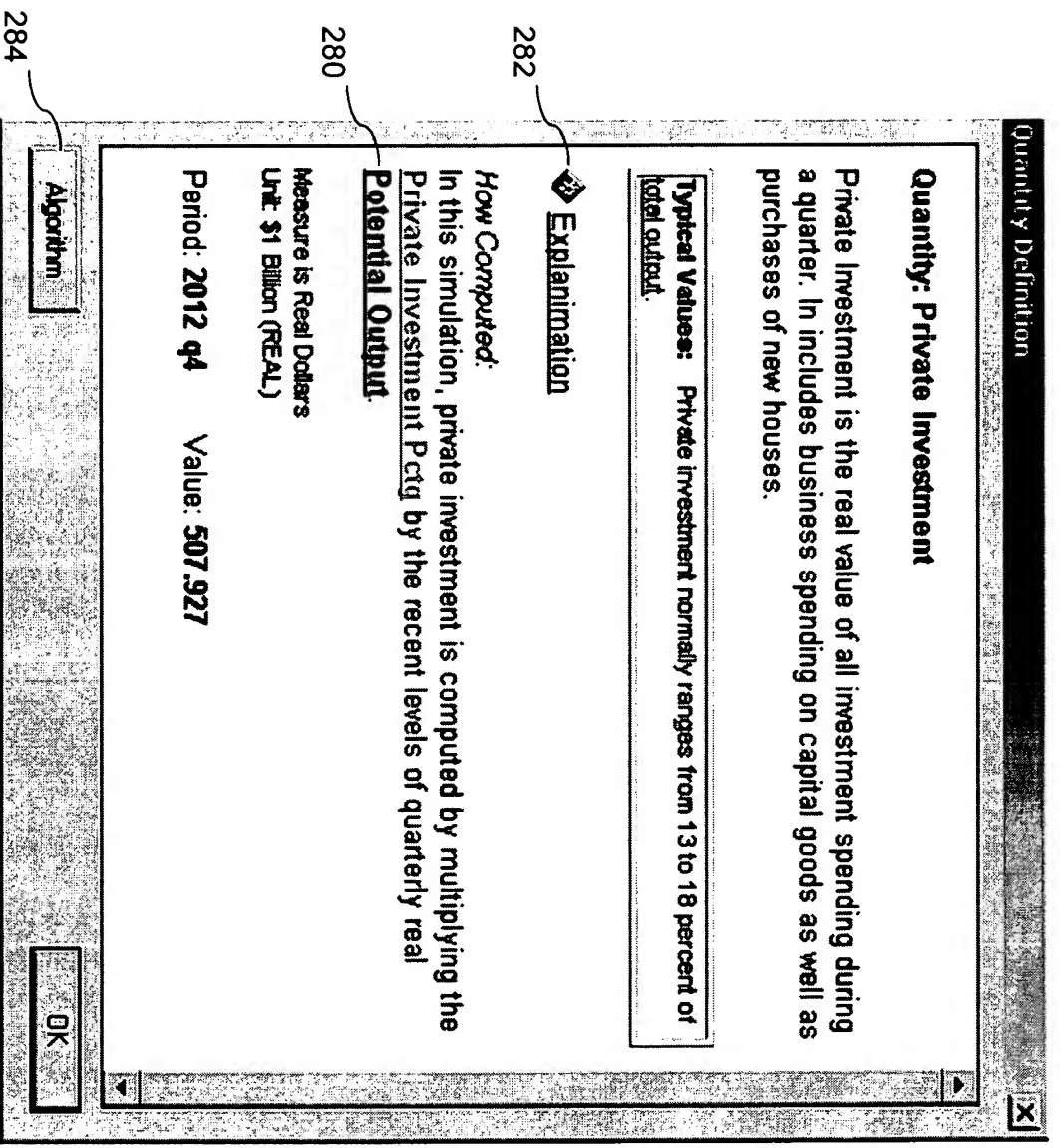


FIG. 21

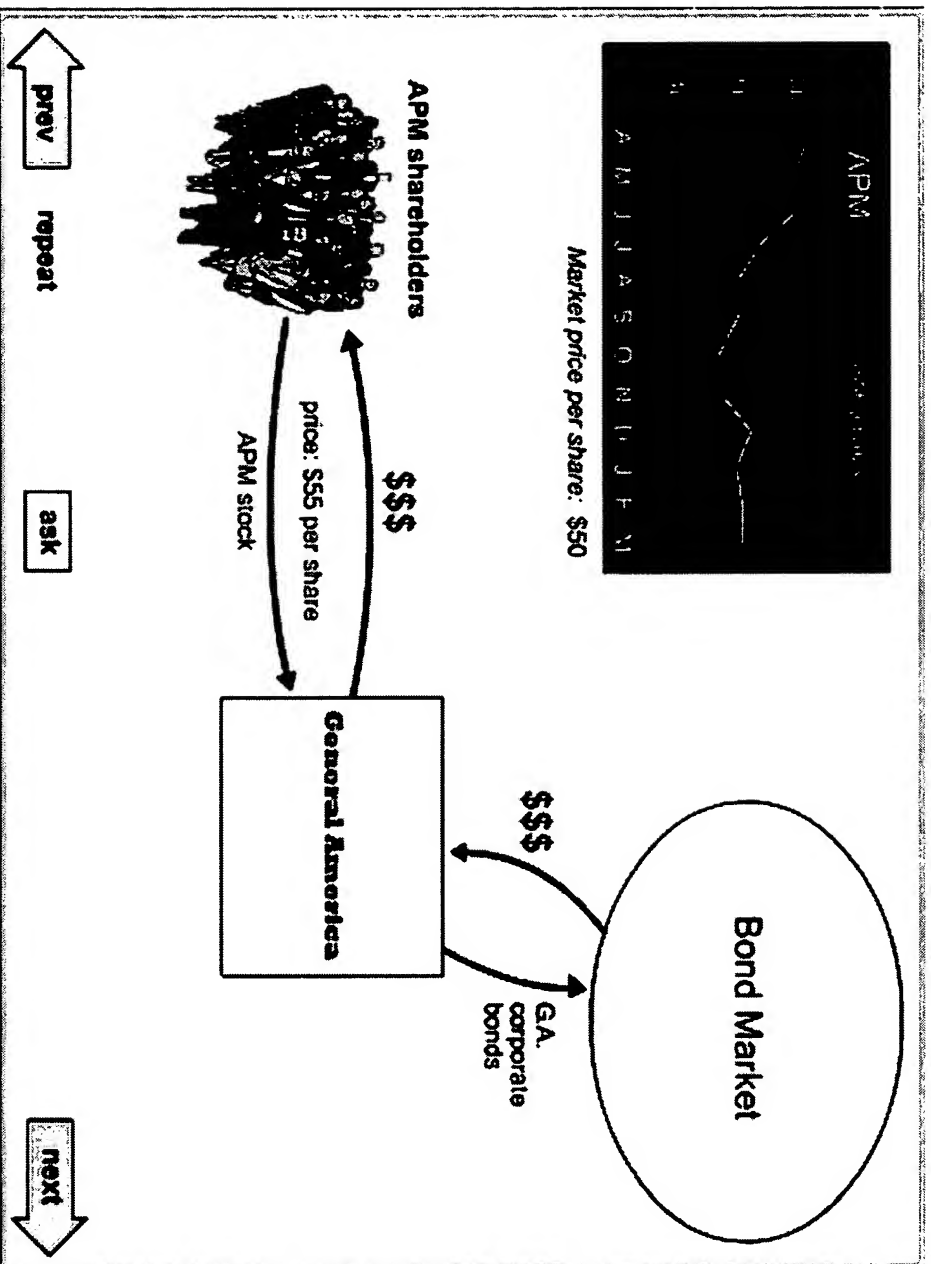


FIG. 22

Algorithm

Quantity: Private Investment Period selected for analysis: 2012 q4 Quantity value: 507.927

ACTUAL. Computation of this quantity's value each quarter depends upon the values of the following terms. Also shown is the value of each term, as of the selected period. (Click "More Detail" for further technical information about these algorithms.)

Average( "Potential Output", -8, -1 )	3174.54
Value( "Private Investment Pctg", 0 )	16

value of "Private Investment", at period 2012 q4: 507.927

Description of algorithm:

ALGORITHM. Below is the complete internal algorithm for this quantity. It is written using the C++ programming language, and it even includes any notes, issues, or comments typed in by the simulation model designers.

double dRecentPotentialOutput = Average( "Potential Output", -8, -1 );

dQResult = (Value( "Private Investment Pctg", 0 ) / 100.0) \* dRecentPotentialOutput;

The final value for this quantity is put in the variable "dQResult".

More Detail

Done

FIG. 23





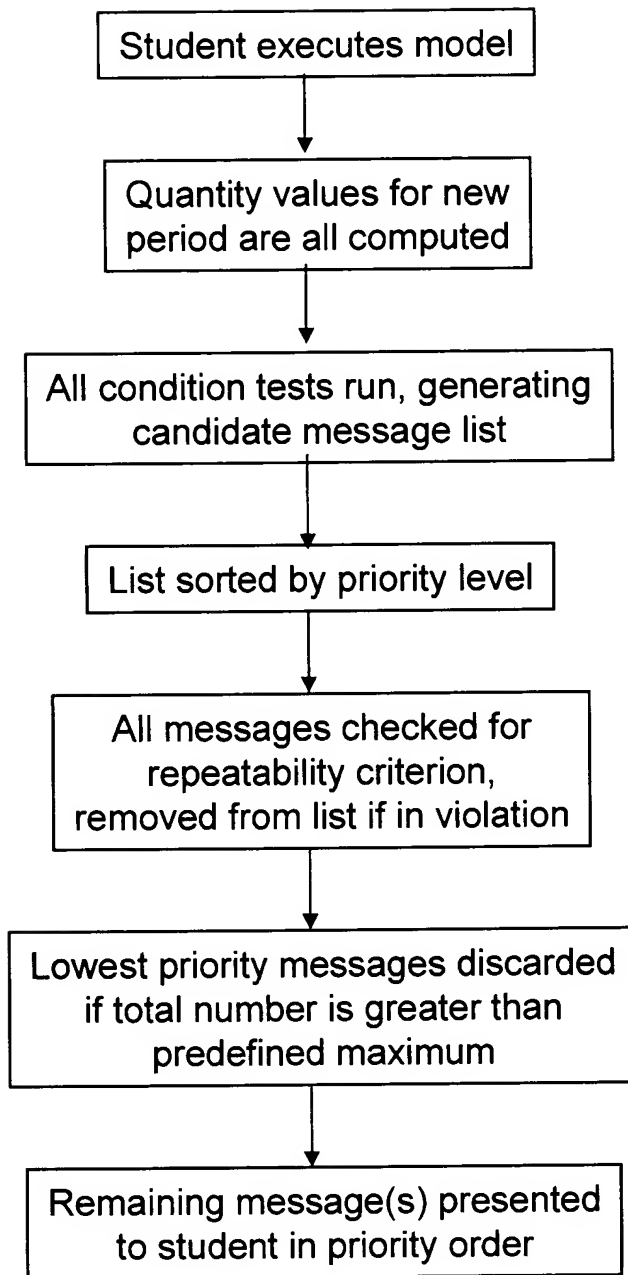


FIG. 25